

What you've been longing to know about the ocean!
*Jennifer Stock, George Matsumoto, Sarah Allen, Scot Anderson,
Dan Howard, Tierney Thys, Ben Becker, Bob Van Syoc,
Chris Pincetich, Wallace J. Nichols*
Guests: Students from Ocean Shore School, Pacifica, CA

Students from Ocean Shore School in Pacifica, CA have been getting ready for an in depth study of the ocean for Oceans Week. Listen to students from grades K-8 ask their questions about the ocean and listen to experts' answers as we all learn something new and ponder the incredible amount of knowledge we've gained about the ocean by asking questions!

Jennifer Stock: You're listening to Ocean Currents, a podcast brought to you by NOAA's Cordell Bank National Marine Sanctuary. This radio program was originally broadcast on KWMR in Point Reyes Station, California. Thanks for listening!

Jennifer Stock: And welcome to another edition of Ocean currents, I'm your host Jennifer Stock. Ocean Currents is part of West Marin's Matter Series, where every Monday at 1 you can tune-in to listen to a show about our environment, and Ocean Currents is always the first Monday of every month.

On this show we talk with scientists, educators, explorers, policy makers, ocean enthusiasts, adventures, advocates, students and teachers, and more- all uncovering and learning about the mysterious and vital part of our planet, the blue ocean. I bring the show to West Marin Monthly, and I work with NOAA's Cordell Bank National Marine Sanctuary, one of four national marine sanctuaries in California, all working to protect unique and biologically diverse ecosystems.

Here we are in may, we're rolling out of earth day celebrations, and getting ready for World Ocean's Day, coming in June. As school are getting ready to wind up the school year, wind down the school year, and for Ocean Shore's school in Pacifica, California, they're getting ready for oceans week, where the entire school, grades Kindergarten through eighth, get ready for a week of in depth study all about the ocean. And they've been preparing for this all year, for this coming week in May, with projects and assignments and special events focused on the ocean. At one event during the year students had the opportunity to submit one question they had about the ocean, and I volunteered to track down an expert to answer it. And I had over one hundred questions submitted from the students, and each one of them was so fantastic, spanning a wide range of topics, but unfortunately I did have to select only some to cover in a one-hour show, and get all

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the answers to them. So today, you are guaranteed to learn something new about our ocean through the voices of children. So sit back, relax, and enjoy the show.

One thing that was particularly interesting is that some of these questions were really challenging to answer, and while talking with the marine scientists to get the answers I heard this a lot:

Marine Scientists: (collected responses) "Well, that's a good question." "Wow!" "That is a great question." "That's a good question." "Well, that's a great question." "That's kinda' cool." "Well, that's a great question..."

Jennifer Stock: So a lot a lot of great questions, a lot of these experts were somewhat stumped in some of these questions, so it was a lot of fun to track down the meat of the answers. So let's get started and hear about our experts and the questions! Thanks for tuning in to Ocean Currents today.

George Matsumoto: My name is George Matsumoto, I am the senior research and education specialist at the Monterey Bay Aquarium Research Institute, which means I get to do things like study jellies and talk to people.

Sarah Allen: My name is Sarah Allen, I work with the National Parks Service in the Pacific west region in the Coast and Oceans program.

Scott Anderson: Hi, my name's Scott Anderson. I've been studying sharks out here off the coast of California for 25 years, and mainly white sharks at the Farallon Islands and Tomales Point.

Dan Howard: My name is Dan Howard and I am the superintendant at the Cordell Bank National Marine Sanctuary, which is a marine protected area that is west of Point Reyes, California.

Tierney Thys: Well, my name is Tierney Thys and I've been studying the ocean for many years, I'm a marine biologist, National Geographic explorer, filmmaker, and ocean conservationist.

Ben Becker: My name's Ben Becker, I'm a marine biologist at Point Reyes National Seashore.

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Bob Van Syoc: Well, my name is Bob Van Syoc, and I'm an invertebrate zoology research fellow at the California Academy of Sciences in San Francisco.

Chris Pincetich: My name is Chris Pincetich and I work at the nonprofit Turtle Island Restoration Network.

Jay Nichols: My name is Jay Nichols and I'm a marine biologist, and I've spent the last 20 years or so studying sea turtles and the human ocean neurological connection.

Jennifer Stock: I'm Jennifer Stock, I'm the education and outreach director for the Cordell Bank National Marine Sanctuary. I've been learning about and teaching people of all ages about the ocean for over 15 years.

(Musical interlude)

| *Sydney:* My name is Sydney, and my question is: Does the weather [affect](#) the ocean?

Tierney Thys: Yes, and yes! It's a silent but amazingly powerful dialogue that goes on between the sky and the sea. If you live in an area where you get lots of fog, well that's when the land heats up, and when it hits cold air from the ocean, that creates fog. A warmer planet is a windier planet, and wind can cause incredible things to happen in the ocean by pushing things off shore, and create something called upwelling. So there's just this dynamic conversation between the sky and the sea, and they both affect each other.

Elizabeth: My name is Elizabeth and my question is: what are some things the ocean can control? Is water the most powerful thing on the planet?

Jay Nichols: Well the ocean is involved in our climate and our weather, it is involved in what our coastline looks like, it moves sand and rocks around. I wouldn't quite say it controls the coast, or it controls the weather, but it definitely influences it.

Annie: Hi, my name is Annie, and my question is: why is the ocean so salty?

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- Bob Van Syoc:* That is a great question. The ocean is salty mostly because of all the minerals that are coming out of the rocks that the ocean is surrounded with.
- Avery:* Hi, my name is Avery, and my question is: what would happen to the ocean if there was no moon?
- Dan Howard:* We wouldn't have the tides that we have now, the low tide and the high tide, because the moon wouldn't be there to pull on the oceans. And another thing is that some of the rockfish will feed at night during full moons, and so they wouldn't have that light to feed by if there was no moon for them. So lots of things in the ocean would be very, very different without the moon.
- Riley:* My name is Riley and my question is: why is the ocean different colors in different areas?
- Dan Howard:* Well, first of all the ocean is different colors because there are different materials in the ocean, so that you might see the ocean near the mouth of a river would be a bit brown or greenish brown because of all the sediments that are washing out of the river. In different places offshore it could be darker green because of all the phytoplankton that's in the water. But other places, because the ocean absorbs different wavelengths of lights, different wavelengths of color get absorbed by the ocean and often times blue is the only wavelength that's left. Some time in tropical places the ocean might look bluer, so all different kinds of things can control the color of the ocean.
- Mia:* My name is Mia and my question is: when was the ocean created?
- Tierney Thys:* Well, the ocean is upward of 4 billion years old, if not a little bit older. We know that life emerged in that ocean about 3.7 billion years (*sic*: ago), so it took a little while for the ocean to be hospitable to life. So, probably about 4 billion years old.
- Tory:* My name is Tory and my question is: have scientists actually been to the deepest place in the ocean? If not, how are we really sure how deep it really is?
- Dan Howard:* Yes, there've been a few people who have made it to the deepest part of the ocean, which is the Marianas Trench, which is about 36

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thousand feet deep, so the Marianas Trench is deeper than Mt. Everest is tall, Mt. Everest is about 26 thousand feet tall. So they have been down there, but before they got there they knew how deep it was because scientists know how fast sound travels in the water, and so they can introduce sound in the water, and then measure how long it takes for that sound to come back to their instruments, like an echo.

Nina: My name is Nina and my question is: how much does the ocean rise because of global warming?

Tierney Thys: Well, right now the average rate I think is about 3.3 millimeters, but that rate is increasing. How fast that rate will increase depends on a bunch of things, including how warm we make the planet, because warmer water expands, and also, how much of the ice melts, say off of Greenland, as well as Antarctic areas.

Student: How do earthquakes affect the ocean?

Dan Howard: The most obvious effect of earthquakes on the ocean is creation of tsunami or tidal wave, because when we have those continental plates shift under the ocean it create a...not necessarily a big wave, but an extremely powerful wave, that when it hits the coast can do a lot of damage if there's coastal sediments near low lying area. So, a good example of that was the tsunami that hit Japan a couple years ago and all the damage that did to the coastal areas.

Student: When a tsunami happens, why does all the water go really back first?

Sarah Allen: When a tsunami happens, it's a wave that's generated from across the ocean, and that wave get's larger as it moves across the ocean, as it builds up, and when it get's to shore it starts hitting the continental shelf, and it pushes it even further up, so you have water drawn back to make an even larger wave, and so that drawback is what you're experiencing before that wave comes in, in a rush.

Jennifer Stock: Oh! So that water actually becomes part of the wave.

Sarah Allen: It is part of the wave.

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Jennifer Stock: Interesting.

Isabelle: My name is Isabelle and my question is: how much has the ocean changed over the years? And have animals and habitats been affected by global warming?

Sarah Allen: We haven't been studying all creatures in the ocean, but many of the ones that we do have already shown some sort of effect, not all but some of them. An example would be animals that like warm water are benefiting from these changes. Bottlenose Dolphin are occurring more north along the coast of California because they like warmer water, so that's one benefit.

Jennifer Stock: Humboldt Squid?

Sarah Allen: Humboldt Squid. So more Sperm Whales are feeding on Humboldt Squid. Other species may not benefit, such as coral, or cold-water species of Stellar Sea Lions, cold-water fish. There are all sorts of species that would benefit, and not.

Student: Why does that glass become so smooth?

Dan Howard: Sea glass is polished by the ocean. So, if you had a piece of glass that was right by the shoreline every time the tide came in and out it will tumble that little piece of glass, and polish it more and more. So it's kind of unfortunate, but there was a time when people use to throw their trash in the ocean, and a lot of that glass, after years and years of being tumbled back and forth, back and forth in the waves, gets polished, so that now it get's polished into a nice little piece of sea glass.

Jennifer Stock: Nice little find.

Dan Howard: (chuckles) Yeah.

Sophia: My name is Sophia and my question is: why do beaches have different color sand?

Jennifer Stock: Beaches have different color sands based on the color of the rocks that those sands actually originated from. There are many, many different types of rock over the planet, and some of them are black,

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some of them are brown, some of them are red, and eventually over time rocks erode and become smaller and smaller and tumble and weather, with rain and with colliding between each other, and especially on the beaches they erode quickly because the ocean waves tumble the rocks around to become smaller and smaller grains of sand. So the different colors of sand are based on the types of rock that the sand actually came from. It's a fun thing to different beaches around the world and see the different colors of sand and realize how diverse our geology is on our planet.

Zachary: My name is Zachary and my question is: is there more life on the sea or on the land?

Jay Nichols: The is way, way, way, way, way, way, way, way more life in the sea than there is on land. Period. There's more life in...in one little drop of water, there's millions of organisms, so just imagine how much life there is in the whole ocean.

Ruthie: My name is Ruthie and my question is: why does the ocean foam up when it touches the shore?

George Matsumoto: The ocean foams up because there's lots of things in the water that you wouldn't get in something like drinking water, so there are things like sugars, and slimes from other animals, and when it hits the shore it gets sort of getting stirred up and it's getting a little bit of oxygen in there, and it makes the bubbles that you like to see at the ocean.

Jennifer Stock: I've also heard that it's phytoplankton, and different types of plankton?

George Matsumoto: Well the phytoplankton, uh, the diatoms, and diaphlanges also produce slime and that helps make the foam, but it's mostly things that are discarded- sugars and slime and mucus, and it all gets mixed in with the air, because the ocean, the waters hitting the beach and getting stirred up.

Student: Can crabs ride waves?

Ben Becker: Baby crabs can ride waves. The main way that most marine crabs disperse and kind of get around the ocean when they're babies is

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they're really tiny and they become plankton and they float around on the waves and currents, and then eventually, once they get big enough, they top riding the waves and settle down on the bottom and make a home there until they have more babies that go out and ride the waves to find a new home.

Jay Nichols: I've seen crabs ride turtles, I've seen crabs ride whales, I've never seen them ride waves but I imagine they probably can.

Talia: My name is Talia and my question is: how to animals that live on the bottom of the ocean find their food?

Jennifer Stock: Animals that live on the bottom of the ocean have different adaptations for surviving overall; they're adapted for surviving under great, tremendous pressure, having all that water on top of them. There's not a lot of light down there, very little to none, and so they really have to have different adaptations for finding their food. Some animals have a really good sense of smell and can just sense their way around. Deep-sea corals, that can see in the darkness, have a really interesting strategy in that they put their polyps out to catch any detrital material that's floating by. Detrital material meaning anything that's drifted down from above, like plankton or other materials that might be floating by, and hey just use these little polyps, kind of like little hands, and grab it and bring it in. Other animals might use light to attract prey or to find a mate, that's called bioluminescence. And so there's all sorts of different strategies for animals in the deep sea to find food.

Student: Which animals in the ocean eat seaweed?

Ben Becker: Well, algae is all over especially the coastal ocean, and it's full of carbohydrates, so pretty much any species that is interested in getting some carbohydrates easily will eat it, but of course you have to be adapted to eat it, so lots of things like snails in the inner tidal, even some birds will eat it, some mammals will eat seaweed, one really well known mammal that likes to eat seaweed are sea urchins, which like to eat giant kelp, which is just a form of seaweed, and the sea urchins can mow down huge tracks of kelp, just like a lawn mower, by eating up the algae.

Sarah Allen: People eat seaweed too.

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- Padma:* My name is Padma, and my question is: What kind of seaweed goes into ice cream and diet soda?
- Chris Pincetich:* Several seaweeds that go into the commercial products that use the gelatin extract from seaweed, so it's different depending on where it's harvested. So it could be the giant kelp, it could be the other species in other countries.
- Andy:* Hi, my name is Andy, and my question is: why do some fish (sic: swim in schools)
- Chris Pincetich:* Well fish schools is mainly for protection. There's safety in numbers, they know their large mass swirling through the ocean can often be confusing to predators, it's really daunting to figure out, "How do I get just one?" And the movements of the collective mass can often confuse them. So, they mostly school for their own protection.
- Student:* Do clams have faces?
- Bob Van Syoc:* Well, they do have sensory organs that could I suppose be part of a face, like they have things like eyes, that act as a photo-sensory organ, and they can sense chemicals in the water, so that would be like our nose. And of course, they do eat, and they have a mouth! So, if you put all those things together, I suppose they might have a face.
- Keaton:* My name is Keaton, and my question is: why are octopuses so smart?
- Bob Van Syoc:* Well, that's a great question, they've evolved rather large brains, and perhaps one of the reasons they've done that is they're very, very visual. They've got the most evolved eye of any animal without a backbone, and so using that big eye requires a large optic nerve and that requires a big brain to process all the data coming from the images those eyes collect, so that's probably why. They're also relatively social, they'll school, and any social activity like schooling requires a bigger brain to pull that off. Now they do really kind of interesting things with their skin, they can change color, they can glow, they can change the texture of their body. And so being able to process the data of what their

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environment looks like helps them match the texture with their skin, and also the color.

Student: How big is a giant squid?

Bob Van Syoc: How big is a giant squid! I was wondering how long a giant squid is, they're probably about 25 to 30 feet long. They're not the biggest squid anymore, because now we have the colossal squid, which gets somewhere between 45 and 60 feet long. So I don't know what we're going to do when we find the next big squid because we already have the jumbo squid, the giant squid, and now the colossal squid, so someone's going to need to come up with another name.

Student: How do squids produce ink?

Bob Van Syoc: Squids produce ink, they get the color for their ink from their diet, so whatever they're eating, and they pull it all together and they put it into a special place call the, "ink sac," and that's where is gets squirted out from.

Simone: My name is Simone and my question is: If jellyfish have no brains then how can they survive?

George Matsumoto: Well they're very successful at what they do. They have a very simple nervous system that's more like the nervous system that's in our stomachs. So they're able to do simple things, they can move their bell around to swim a little bit, and they can contract their bell to move, and swim and float, and feed. So they're able to do all those things, really without having a complex brain or a lot of complex behavior, they generally just float along with the currents, and so long as they can reproduce and make more jellies, and eat, they're going to be successful.

Student: Why do anemones not hurt Clownfish?

George Matsumoto: Why do anemones not hurt Clownfish? That is a very good question, it's one we get a lot. The Clownfish like to hide out inside the anemone and they get protection by the anemone from predators. The Clownfish are not hurt by the anemones because they cover themselves with some anemone slime, so the anemone thinks it's just another part of itself.

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- Mathew:* My name is Mathew, and I'm wondering: how does a one-pound fish survive 100,000 pounds of water on its body?
- Ben Becker:* Everything on the earth has pressure on its body. So right now we're talking about at sea level, so we've got about 14 pounds of pressure on every square inch of our body, and the reason we're able to deal with that, it doesn't feel like we're pushing, or being pushed on, is the pressure inside our body is the same, so it's like it's pushing out and in at the same strength. So as you go underwater, as long as the pressure on the inside and the outside of our body, or the inside and the outside of your cell, are at the same level, there's no real stress on your system. The problem is when you dive really fast, or you go up really fast, or if you go up to the top of a mountain really fast the pressure isn't the same on the inside and the outside and your ears pop if you're just climbing a mountain, but if you are down at the bottom of the ocean your eyes will bulge out, and the gas in your blood stream will bubble up.
- Student:* What do sharks eat?
- Scott Anderson:* Sharks eat all kinds of other animals. So they're a predator, depending on the shark. So a white shark feeds on seals when they get older and fish when they're little. The whale shark actually, which is thought to be a plankton feeder, feeds on small fish, and things like that, and krill, which are small shrimp like animals.
- Student:* How many different types of sea turtles are there?
- Jay Nichols:* There are seven species of sea turtle in the world.
- Chris:* Two of the species, the Kemp really, and the Flatback sea turtle are only found in small areas of the world, the Kemp is found only on the gulf of Mexico, and then on the east coast of the United States, and the Flatback sea turtle is only found in Australia, and in the East Indian Ocean, and the other five species are found around the world.
- Jay Nichols:* And scientists like to break the species down into populations, sometimes subspecies, but that gets a little complicated, scientists don't always agree on those designations.

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Chris Pincetich: The Leatherback is the official marine reptile of the state of California, and this coming October 15th is going to be the first official Leatherback conservation day in California, so we're excited to celebrate that.

Kailin: My name is Kailin, my question is: Would a shark eat a shark?

Scott Anderson: Well that's a good question, You bet, a shark would eat a shark. Especially a large shark would eat a small shark, if given the opportunity. It depends on the situation, but yeah, there's no reason to discriminate against sharks eating sharks, or sharks eating fish, or birds, or mammals. They eat what they can when they can.

Jennifer Stock: Is there some threat of some sharks eating baby sharks when they're in the utero?

Scott Anderson: Ok, so there is a thing some sharks do called inner uteral cannibalism, where the young sharks are born, or are actually growing up inside the mother, and the larger ones will consuming the smaller ones, actually sounds like a horror story, but it's true, and digesting them, and then being able to get larger themselves. So it's a way of reducing down a litter of eight down to maybe 2.

Scott Anderson: Sharks eat all kinds of other animals. So they're a predator, depending on the shark. So a white shark feeds on seals when they get older and fish when they're little. The whale shark actually, which is thought to be a plankton feeder, feeds on small fish, and things like that, and krill, which are small shrimp like animals.
(repeat)

(Musical Interlude)

Jennifer Stock: You're listening KWMR, at 90.5 Point Reyes station, and 89.9 Bolinas. You're also tuned to Ocean Currents, and for those of you tuning in you're hearing an assortment of questions with expert answers, and these questions come from students at Ocean Shore school in Pacifica, California, they're getting ready for Oceans Week, where they really do an in-depth study, where the parents and teachers and students have been working really hard. So here is an assortment of the questions and answers.

(Musical Interlude)

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Sebastian: My name is Sebastian and my question is: why do some animals in the sea not have bones?

Bob Van Syoc: Well, as a matter of fact most animals in the sea don't have bones, and it's because they evolved a long time ago and many different animals, they didn't have a backbone and so most animals on earth, in fact 98% of them, don't have backbones, they don't have any bones. So, the organisms that do have backbones and bones create a skeleton inside their body and they're able to get much larger on land and move around on land because they've got a much lighter skeleton that can carry all the weight. In the water animals can get much larger and they don't have to have skeletons that can carry all their weight.

Aaron: My name's Aaron and my question is- what happens if different species of fish mate.

Chris Pincetich: Well, for the most part, fish of two different species cannot intermix, at the molecular level the cells will not combine to make a new organism. Some species of fish are closely related and can hybridize, so it's kind of what you see with your pets, with a dog, you can have two dogs breed together and create a new dog that looks like a little bit like both of them, but primarily that does not occur, and you only have interactions with the same species creating more of that species due to the specific genetic and chemical receptors and cues that must combine for successful reproduction.

Henry: My name is Henry and my question is which fish in the ocean are transgender?

Ben Becker: We call transgender for biology, and for animals we typically call them hermaphrodites, and one interesting fish that's a hermaphrodite is the Anemone Fish, and these fish live near anemones. Anemones only have a few fish that can live within them, so one reason you might be a hermaphrodite is because it might be really hard to find another animal, or another fish of the opposite sex to breed with. So if you're a hermaphrodite you're kind of increasing your chances of finding someone you can mate with. The Anemone fish in particular, only three or four or five fish can live inside the anemone and that means there's not a lot of

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other fish around, there's really just a population on maybe four fish, and they're what's called sequential hermaphrodites, they start out as young males, and then as they get older they become females. So the little guys are the males in the anemone, and they can have babies with the older females, and then when the older females die, and pass away, the males can become bigger and become females and then some smaller males move in so they can have this nice little family, and that's the advantage of being a hermaphrodite.

Jennifer Stock: Wow.

Ben Becker: The Sheephead, off of California, they're also a hermaphrodite.

Jennifer Stock: They're down in the kelp forests, down south, Southern California?

Ben Becker: Yeah, and one reason that those fish maybe hermaphrodites, is that larger fish are typically able to have a lot more babies, so it might be an advantage to be a female when you're larger, when you're older, to have a lot of babies, it might be an advantage to be a male when you're younger because there's no reason to be large, and you can still fertilize a lot of eggs.

Evelyn: My name is Evelyn, and my question is: why do the waves glow at night sometimes?

Bob Van Syoc: Well the waves glow because there are tiny organisms in them that are emitting light. Isn't that amazing? Tiny organisms that can make their own light, and they make it by mixing two chemicals that they make in their bodies, they have these chemicals in the bodies, and when they're moved around in the water, they're disturbed, the two chemicals come together and they emit light, they glow. So, you're able to see them when the waves crash, it mixes all these small organisms in the water and it creates the light from the two chemicals inside the bodies of these small organisms, and it creates light. Well they're tiny, tiny plants, they're actually kind of almost a plant/animal because they're able to move around, they have a flagellum, it's a little whip-like tail that they're able to flick back and forth and move around.

Sarah Allen: Dinoflagellates!

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- Bob Van Syoc:* But they photosynthesize, they use energy from the sun to create food for themselves, simple starches, through photosynthesis, and they're in turn eaten by many other organisms in the sea, so they form the basis for the complex food web that supports all of life.
- Ben Becker:* There're lots of organisms in the world that glow, and have bioluminescence, and most of them are either doing it to deter predators, or to attract mates, or sometimes to find food and attract food.
- Student:* Can dolphins understand the human language?
- Sarah Allen:* Some dolphins species do appear to understand human language particularly those who are brought into captivity and are trained, so if you go to an aquarium and you see dolphins performing, they obviously understand human language, but dolphins in the wild have developed relationships with individuals or people, this has been documented in Hawaii, where there seems to be some sort of communication going on between the two species.
- Emily:* My name's Emily and my question is: do whales have a hole to put water up?
- Jennifer Stock:* Well all whales to have a blowhole, and the blowhole is actually like our nose, like our nostrils, to breathe air in as well as exhale air out. The whales happen to have this on top of their head because that's how they evolved in the ocean, to surface and have it closest to the air to exchange the air. Now sometimes when we see a whale come to the surface we do see an exhalation of air, a big spout almost, but it's really air and water mixed, and basically it's just that little bit of water sitting on top of the whale, right around where that pocket where the blowhole is, and when they force the air out of that blowhole a big spray comes out, and it sort of looks like a spout of water but really it's a spray of air mixed with water.
- Student:* What is the longest living ocean fish?
- Bob Van Syoc:* Well there's some evidence that there are fish that we know that live to over 100 years old, some of the big Rock Fish have been caught up in Alaska, and even along California's coast, we know that they're over 100 years old. Now there many other fish that get

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much older, there's evidence that some small freshwater fish like Coy that live in small ponds and fresh water, those can be over 100 years old as well, some of them. And then there are many other fish we don't know how long they live, it's a mystery, they live in the deep sea, in environments that are difficult for us to get to, and we just don't know about them, so there maybe fish that live even longer than 100 even 200 years old.

Bella: My name's Bella and my question is: do fish sleep?

Tierney Thys: Sleeping can be defined Technically. When we sleep we go through different periods of sleep, deep sleep and light sleep. For instance, Parrot Fish with create this sleeping bag of mucus, and they will essentially rest in that during the night. Now whether it's technically sleep or not, it's resting. So it's equivalent to the way we sleep.

Student: Why don't fish blink?

Chris Pincetich: Well some fish do blink, they have clear, transparent eyelids that you just can't see. Not every species of fish does this, and one of the things that makes fish biology so fascinating and one of my favorite subjects is because there's so many different kinds of fish, so many adaptations in all of those fish for them to behave just a little bit differently and for them to occupy the many, many different areas of the ocean.

Leith: My name is Leith, and my question is: is there an animal in the ocean that doesn't poop?

Ben Becker: You know anything that's alive needs to get rid of waste products whether you're getting rid of carbon dioxide when you breath, whether your kidneys are taking the byproducts out of your body and excreting them, so all of the animals of the ocean you know, all the animals of the ocean are pretty much the sometimes those really tiny ones, those waste products will dissolve out of their bodies, especially if they're a single celled organism, or they'll have a special mechanism for excreting those waste molecules out of the body, but it's still all doing the same thing.

Jennifer Stocks: You make poop sound very scientific. (laughs)

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Ben Becker: It is.

Maggie: My name's Maggie and I want to know: do sharks have live babies, eggs, or both?

Scott Anderson: Well, that's a good question in that they have three different ways of having young. One is live birth, the other is they lay an egg case and the shark hatches out of that, and the third is where they have an egg case inside the mother, it hatches out inside the mother, and then is born alive. So good question, pretty much covered it all.

Jennifer Stock: Can you give us a couple examples of each of those?

Scott Anderson: Yeah, so a good example of a live birth would be the white shark, has 7 to nine young that are about 50 pounds and five feet long when they're born. And then sharks such as horn shark are born in an egg case, and actually, the egg case is laid on the bottom and then they hatch out of that.

Jennifer Stock: And how about the one where they have eggs that hatch out?

Scott Anderson: A good example of shark that hatches inside its mother, and then is born alive is the Whale Shark. Until recently no one knew how Whale were born, but they had found an egg case with a small whale shark in it and so it was thought that they were born in an egg case, but actually they caught a large female that was full of young they had already hatched out of the egg case and were ready to go, and there was over three hundred of them.

Jennifer Stock: Wow!

Scott Anderson: Yeah, so it's a large amount of young babies, they're very small though when they're born, less than one foot.

Jennifer Stock: Here's an advance question: With these three different strategies for reproduction is that an evolutionary benefit towards long-term survival?

Scott Anderson: Yeah, any time your offspring can be larger and more capable of survival you're going to have a greater survival rate. The only problem with shark fecundity is that...

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Jennifer Stock: That's reproductive success.

Scott Anderson: Yeah, the only problem with sharks, "reproductive success," is that have few young so in times of depletion it's slow to recover. But in times of standard feeding where the population is stable, that is a better mode of reproduction because the young have a better chance of survival.

Lillian: My name is Lillian and my question is: why sharks die if they stop swimming?

Scott Anderson: Well, actually, not all sharks do. There's a group of sharks that are oceanic, and they swim out in the middle of the ocean, and there are no barriers there- up down, left or right, you can go any direction and not run into anything. Those animals are always on the move, and they always have to swim forward, and therefore they are always moving and breathing while they move forward. The other sharks that are known to be in coral reefs, and places where they can be on the bottom, or sit on the bottom, like Angel Sharks, they can breath without moving forward. So it depends on the species but the ones that do live in the open ocean, if the stop swimming they wont be able to get oxygen through their gills.

Joshua: My name's Joshua and my question is: what does it does it feel like seeing a shark?

Scott Anderson: Ah! Well, the way I see them it feels really good because I'm not in the water with them, being afraid that I might be attacked, but yeah. As long as I'm in a safe place I love viewing sharks, they're a beautiful animal, I like to watch the way they swim, if they're eating or whatever, I like to watch that too. But, if I'm in the water and I'm vulnerable, and it's a big shark, I might be scared to see it.

Student: Do sharks have a good memory?

Scott Anderson: Well now, that's a good question because I don't know if it's been tested that much, but from my experience from what I've seen with the white sharks is that, yeah, they have a good memory, good enough to not only survive in the ocean, which is a dangerous enough place, but when we tag them, if they come close enough to the boat and we are able to tag them, then the next time they come

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around they don't come that close. So cause an effect is pretty clear that if you discourage them from something they can learn to stay away. So with White Sharks it's clear, I think you could do a feeding test, where you introduce a scent or an object every time you feed them and they habituate quickly.

Student: When did the Great Pacific Garbage Patch start?

Dan Howard: The Great Pacific Garbage Patch has always been there, but it hasn't always had garbage in it, because it's a gyre. It tends to concentrate the plastics that are there. But plastics, Styrofoam, was first created in 1954, so plastics have really been around for only 50-60 years. And plastics are continuing to accumulate in the Great Pacific Garbage Patch, but they've been collecting there for about 50 years.

Student: Can birds breathe underwater?

Dan Howard: Only for a couple seconds

Jennifer Stock: Can they breath, or are they holding their breath? (laughs)

Dan Howard: No. no, no, no. No, birds, just like marine mammals, they hold their breath under water. They don't have any mechanism for extracting oxygen from water.

Student: Why do people insist on making oilrigs?

Chris Anderson: People insist on making oilrigs because they haven't transitioned to other forms of energy and transportation that require less oil, unfortunately. And there is a bigger problem that the oil companies that own those oilrigs have a lot of political power now that they can contribute endlessly to politicians. So, it's up to the citizens, and every one of us, to show our love for the ocean, and if we're concerned about off shore oil, to share that with our representatives.

Florence: My name is Florence and my question is: is there a cure for Choral Bleaching?

Chris Anderson: Choral Bleaching is when a normal, healthy community full of synthetic micro-organisms is then...well, poisoned basically, and it

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no longer has color in it and it becomes white. Now the causes of Choral Bleaching are not completely, across the board, always the same, so sometimes the cures are different. But yeah! We can bring back reefs that have suffered Choral Bleaching through good water quality management, and sustaining a healthy ocean.

Student: Who owns the ocean?

Experts (en mass): Everybody! Well all do. We all own the ocean. And I guess no body owns the oceans, it belongs to all of us, while we're around. Now we are responsible for stewardship of the ocean. We all benefit from it, whether we like to look at it from the shoreline, or whether fish and swim in it, or breath. We all benefit from it, and we're all responsible stewards for it.

Student: If people mess things up in the ocean wont they have to fix it up?

Sarah Allen: You'd think, "Yes, maybe we should."

Jennifer Stock: It is true we have ton a lot of things to the ocean.

Jay Nichols: Yep. We've done a lot of things to fix. We have made a kind of a mess, and we've broken a lot of things on ocean and land.

Sarah Allen: There's a tipping point and there's not a lot of agreement amongst scientists on what a tipping point is or where it might occur, or if it even does occur. But at some point we may not be able to reverse the direction of what's happening.

Jennifer Stock: So we really need to stop messing it up.

Tierney Thys: But I think we can work together to fix the problems. We can figure out ways to give the ocean a rest, and the ocean can rebuild if we give it a rest, but we need to work together to make that happen.

(Water Flowing Sound)

Mateo: Hello my name is Mateo and my question is: What can we do to save ocean animals?

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- Ben Becker:* The best way to save ocean animals is to use and live near the ocean responsibly. Don't take too much sea life out of the ocean, don't put pollution into the ocean. You know, those are the probably the main things, there are things that you can do beyond that to try and restore animals and plants that have been too degraded, but the biggest general rule is try not to mess things up too much.
- Sarah Allen:* The other thing that you can do is let people know how they can also help the ocean in restoring, in buying things that effect the oceans less, drive efficient cars.
- Jay Nichols:* There are so many things that we can do for ocean animals, I think learning about them is one good thing. Go see them, do that carefully, and responsibly, and politely, but go and actually see the animals, on their terms.
- Scott Anderson:* Comes down to personal preference, what you do with garbage and marine debris, throwing things in the ocean, throwing things away correctly. Recycling. And then just being aware of what's out in the ocean and then sharing that with your friends, and then if things aren't going well, if things are declining then you know, share that. And if everyone knows what's going on, there's enough people to turn things around. It's mainly about people understanding what's out there.
- Jennifer Stock:* You've been listening to Ocean Currents, and you've been listening to student's questions and answers from the experts about the ocean. These were questions from students at Ocean Shore School in Pacifica and experts from all around the bay area. Marine Biologists and Marine Scientists giving their two cents about some of these wonderful deep questions about ocean and the critters inside it and I hope you listened and heard something new that you did not know. There's something for everyone.
- I wanted to thank specifically the students, teachers, parents, and the faculty at Ocean Shore School, this is a lot of work, and especially my sister, Julie Stock for recording all the student's questions, which was awesome. But also I'd love to thank the experts, who gave all their time for the answers, George Matsumoto from the Monterey Bay Aquarium Research Institute, Sarah Allen from the National Park Service, Scott Anderson, local

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shark researcher in west Marin, Dan Howard from Cordell Bank National Marine Sanctuary, Tierney Thys, the National Geographic explorer and marine conservationist, Ben Becker from Point Reyes National Seashore, Bob Van Syoc from the Cal Academy of Sciences, Chris Pincetich from the Turtle Island Restoration Network, and Jane Nichols, turtle biologist and conservation leader. Great group of people, it was super fun to put together and I hope you enjoyed it.

I do have two more minutes and I want to share two announcements with you. We have a photo exhibit in the Point Reyes Library right now, highlighting some of the most beautiful pictures of Cordell Bank National Marine Sanctuary, things that live above the water, in the water, and on the sea floor, some of the most beautiful images that we have. And the exhibit will be up until late June, maybe even early July, and you're welcome to come in anytime the library is open to see these images. And we'll be having a special reception and celebration of Worlds Ocean Day for that, June sixth, 6-8pm, and you'll hear more about that next month or potentially here on KWMR.

And also at the end of the month, May 28th there is a really interesting panel on the ship-strike issue, meaning ship strikes with whales. And this is being put on by the American Cetacean Society, San Francisco bay chapter, on May 28th at 7pm, at the Bay Model Visitors Center. And you can get more information about it on the web, at WWW.ACS-SFBAY.ORG A panel of all the people that have been working on this issue, across organizations, agencies, as well as industry, in terms of how to we reduce the impact to whales from the large ships that come inside the San Francisco bay and outside the San Francisco bay, where we have one of the largest congregations of marine mammals endangered species at that, mostly. So, take a look at that on May 28th.

So, that about wraps it up the show today for Ocean Currents, thanks for tuning in. Ocean Currents is the first Monday of every month, and I have a podcast online at www.cordellbank.noaa.gov, you can go there to get past episodes go into iTunes to subscribe to that. And I'd love to hear from you, listener's comments, questions, ideas for future topics, please email me- Jennifer.stock@noaa.gov Thanks for tuning in today and up next will be Rick Clark with Blues in the 50s'.

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(Exit music)

Jennifer Stock:

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